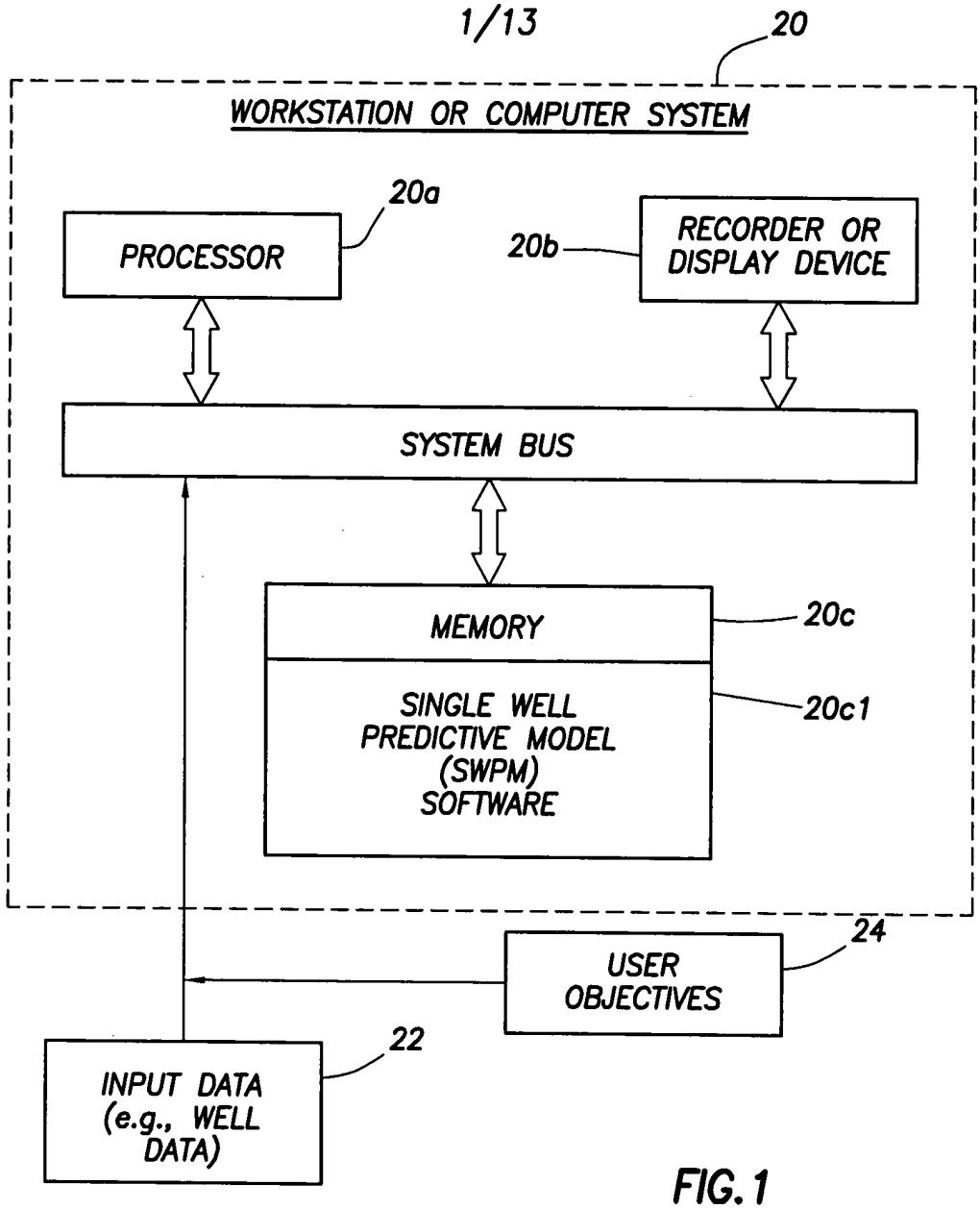
20
WORKSTATION OR COMPUTER SYSTEM
20a
PROCESSOR
20b
RECORDER OR DISPLAY DEVICE
SYSTEM BUS
MEMORY
20c
SINGLE WELL PREDICTIVE MODEL (SWPM) SOFTWARE
20c1
USER OBJECTIVES
24
INPUT DATA (e.g., WELL DATA)
22

FIG. 1

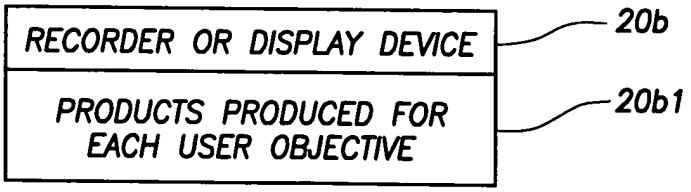
RECORDER OR DISPLAY DEVICE
20b
PRODUCTS PRODUCED FOR EACH USER OBJECTIVE
20b1

FIG. 2

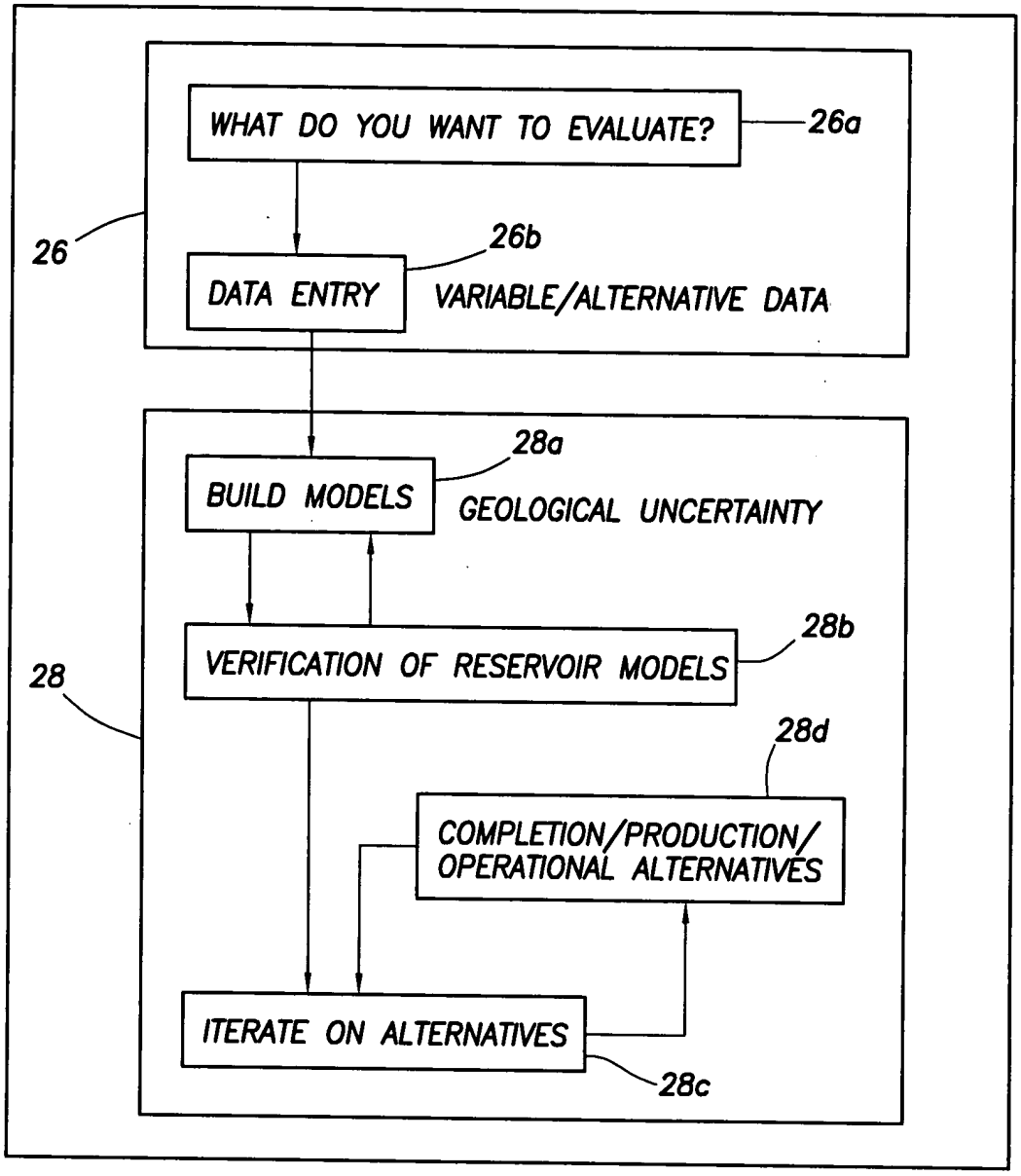
WHAT DO YOU WANT TO EVALUATE?
26a
26
26b
DATA ENTRY
VARIABLE/ALTERNATIVE DATA
28a
BUILD MODELS
GEOLOGICAL UNCERTAINTY
28b
VERIFICATION OF RESERVOIR MODELS
28
28d
COMPLETION/PRODUCTION/
OPERATIONAL ALTERNATIVES
ITERATE ON ALTERNATIVES
28c

FIG.3

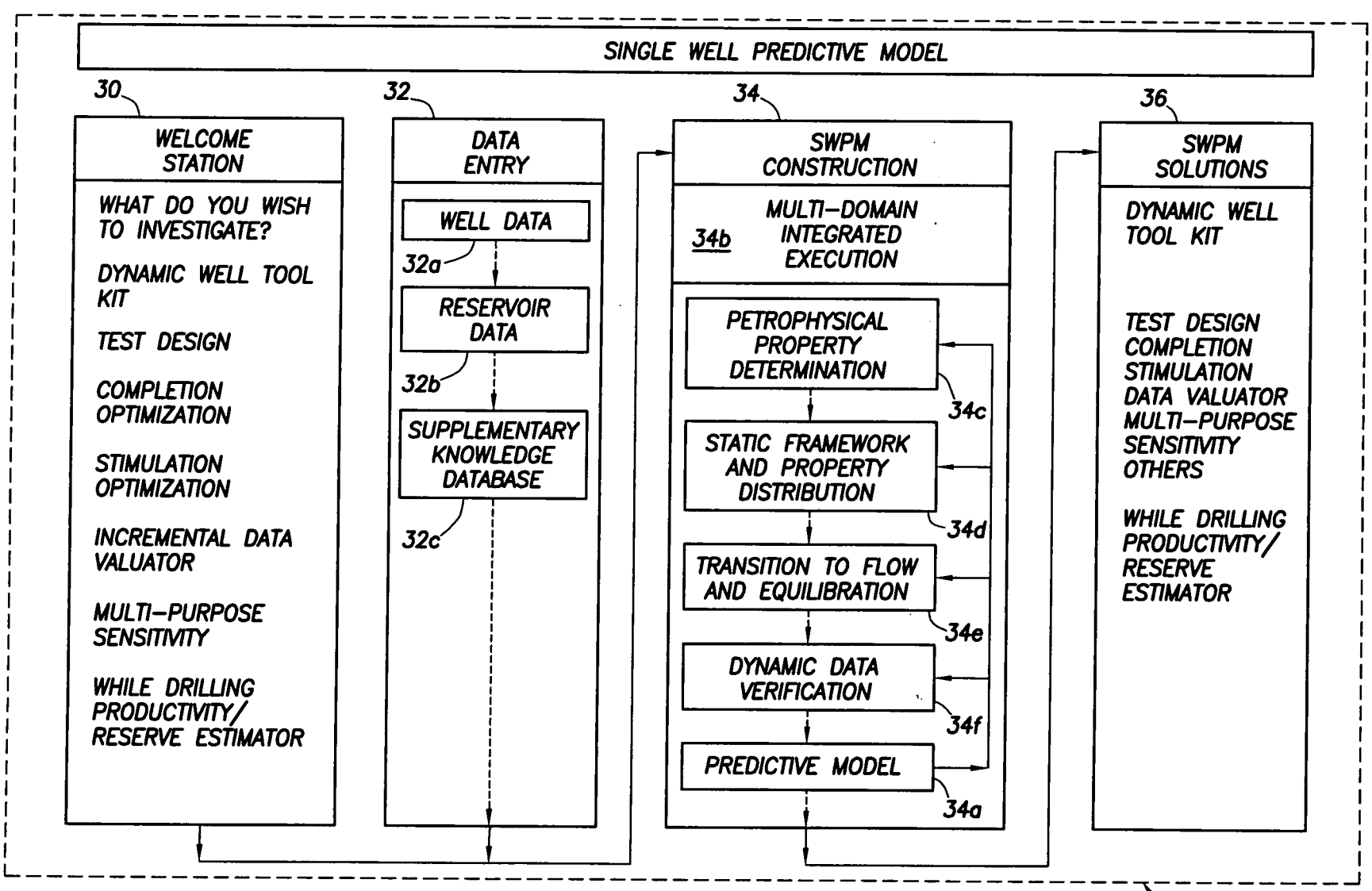
SINGLE WELL PREDICTIVE MODEL
30
WELCOME STATION
WHAT DO YOU WISH TO INVESTIGATE?
DYNAMIC WELL TOOL KIT
TEST DESIGN
COMPLETION OPTIMIZATION
STIMULATION OPTIMIZATION
INCREMENTAL DATA VALUATOR
MULTI-PURPOSE SENSITIVITY
WHILE DRILLING PRODUCTIVITY/ RESERVE ESTIMATOR
32
DATA ENTRY
WELL DATA
32a
RESERVOIR DATA
32b
SUPPLEMENTARY KNOWLEDGE DATABASE
32c
34
SWPM CONSTRUCTION
34b
MULTI-DOMAIN INTEGRATED EXECUTION
PETROPHYSICAL PROPERTY DETERMINATION
34c
STATIC FRAMEWORK AND PROPERTY DISTRIBUTION
34d
TRANSITION TO FLOW AND EQUILIBRATION
34e
DYNAMIC DATA VERIFICATION
34f
PREDICTIVE MODEL
34a
36
SWPM SOLUTIONS
DYNAMIC WELL TOOL KIT
TEST DESIGN
COMPLETION
STIMULATION
DATA VALUATOR
MULTI-PURPOSE
SENSITIVITY
OTHERS
WHILE DRILLING PRODUCTIVITY/ RESERVE ESTIMATOR
20c1

FIG.4

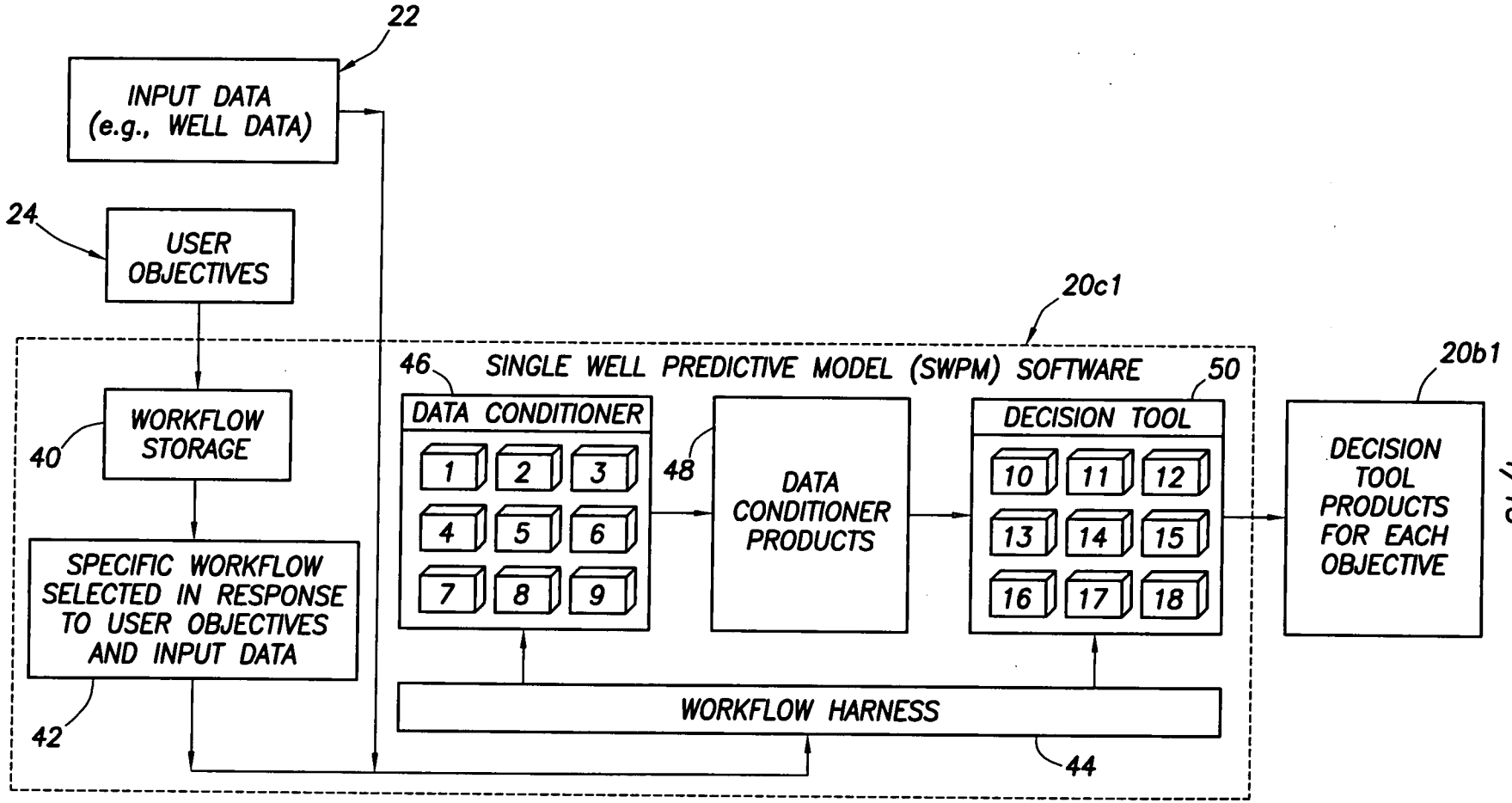
22
INPUT DATA
(e.g., WELL DATA)
24
USER
OBJECTIVES
20c1
46
SINGLE WELL PREDICTIVE MODEL (SWPM) SOFTWARE
50
20b1
WORKFLOW
STORAGE
40
DATA CONDITIONER
1
2
3
4
5
6
7
8
9
48
DATA
CONDITIONER
PRODUCTS
DECISION TOOL
10
11
12
13
14
15
16
17
18
DECISION
TOOL
PRODUCTS
FOR EACH
OBJECTIVE
SPECIFIC WORKFLOW
SELECTED IN RESPONSE
TO USER OBJECTIVES
AND INPUT DATA
42
WORKFLOW HARNESS
44
4/13

FIG.5

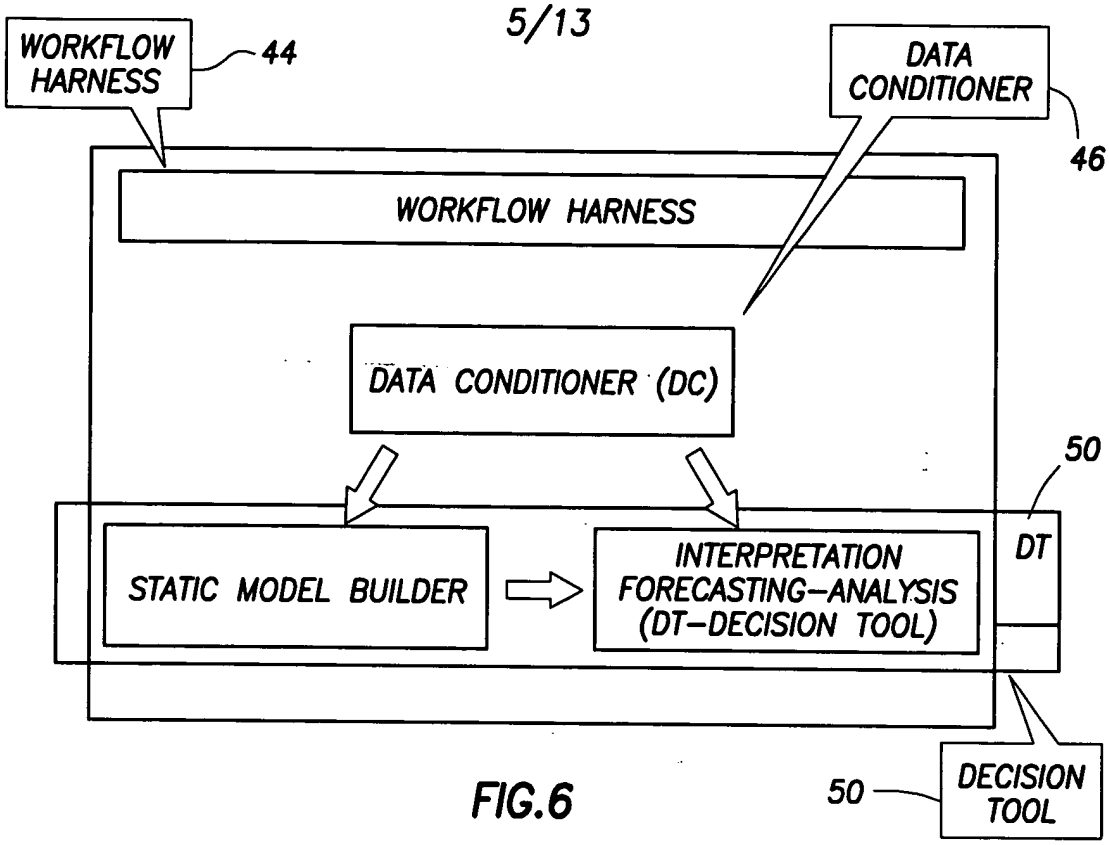
WORKFLOW HARNESS
44
DATA CONDITIONER
46
WORKFLOW HARNESS
DATA CONDITIONER (DC)
50
STATIC MODEL BUILDER
INTERPRETATION FORECASTING–ANALYSIS (DT–DECISION TOOL)
DT
50
DECISION TOOL

FIG.6

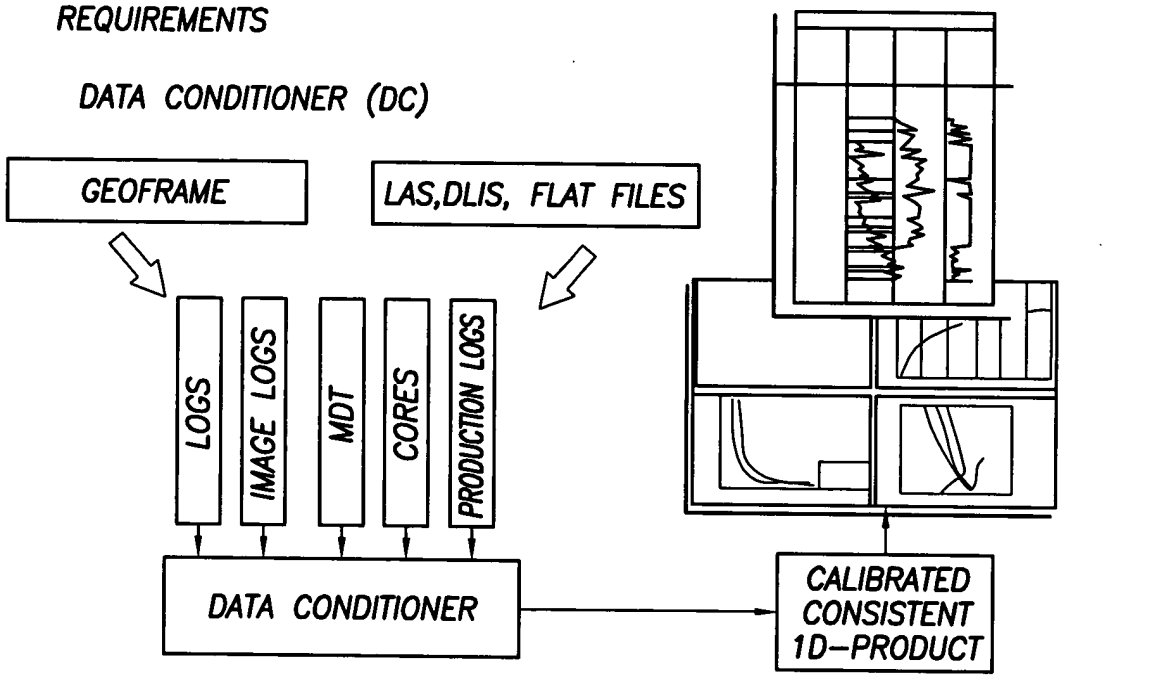
REQUIREMENTS
DATA CONDITIONER (DC)
GEOFRAME
LAS,DLIS, FLAT FILES
LOGS
IMAGE LOGS
MDT
CORES
PRODUCTION LOGS
DATA CONDITIONER
CALIBRATED CONSISTENT 1D–PRODUCT
"FLOW–UNIT ZONATION AND ROCKTYPING
LOG CALIBRATION
AVERAGE PROPERTIES–k,kr,ϕ,Pc,Sw"

FIG.7

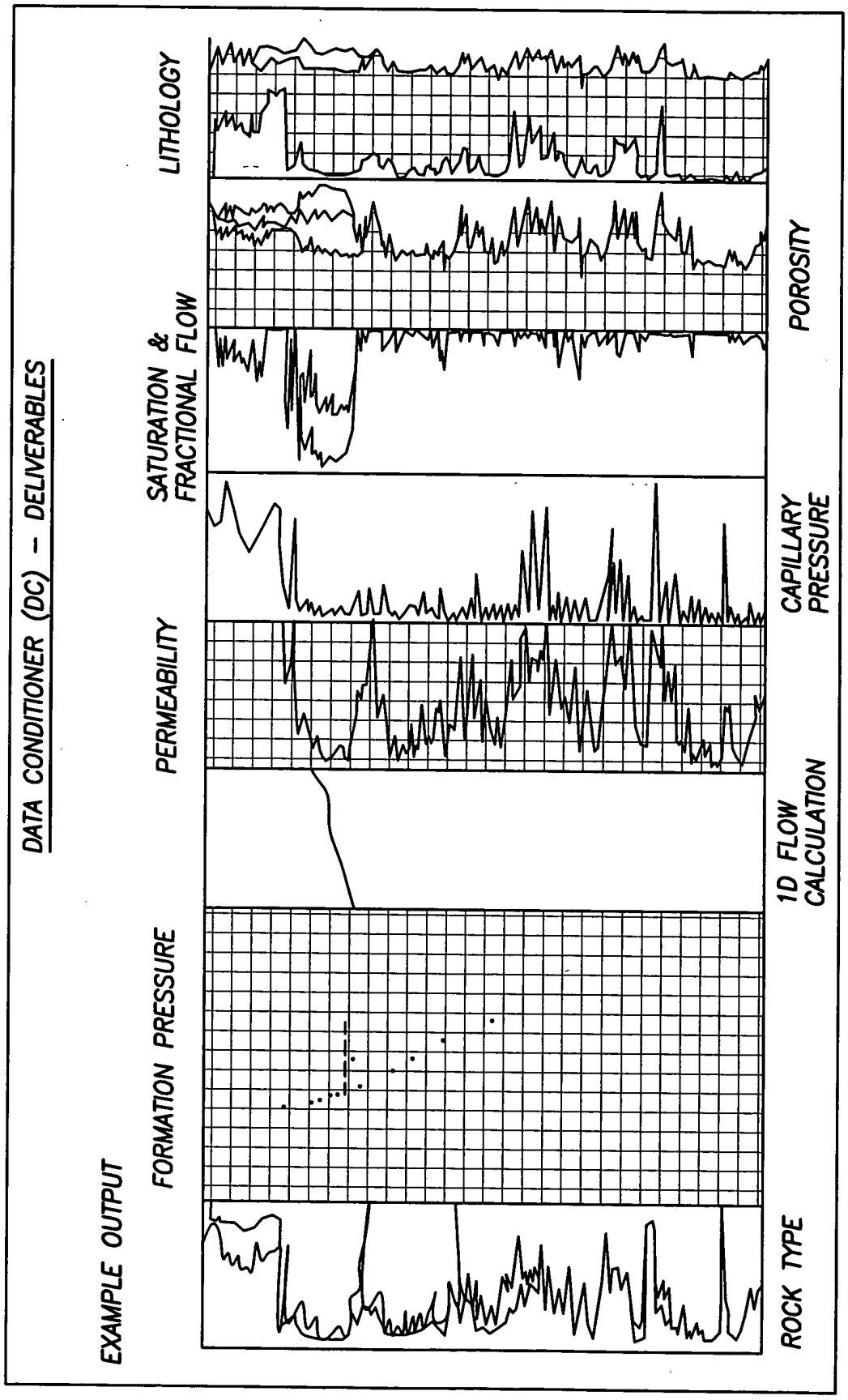
DATA CONDITIONER (DC) – DELIVERABLES
EXAMPLE OUTPUT
FORMATION PRESSURE
PERMEABILITY
SATURATION & FRACTIONAL FLOW
LITHOLOGY
ROCK TYPE
1D FLOW CALCULATION
CAPILLARY PRESSURE
POROSITY

FIG.8

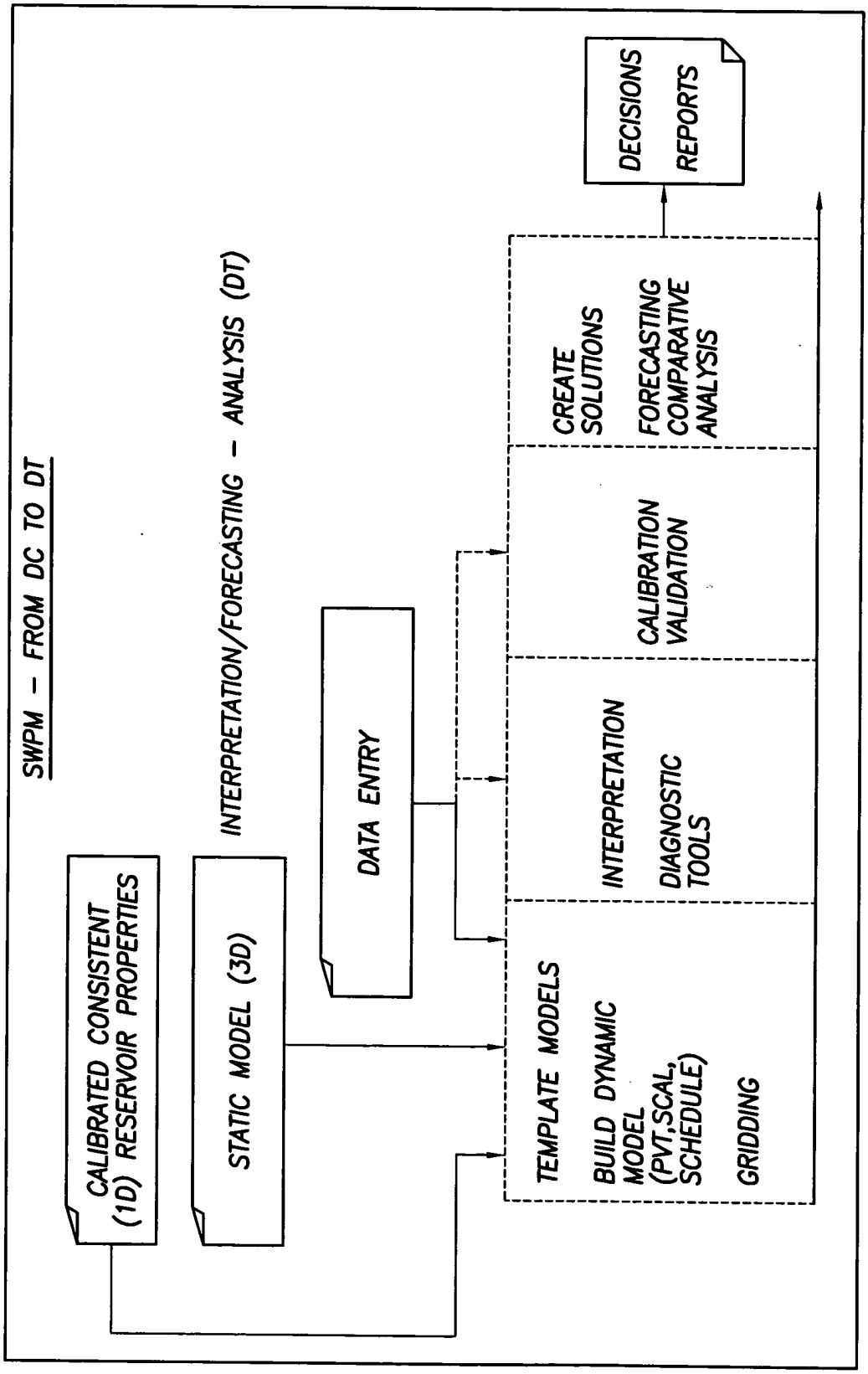
SWPM – FROM DC TO DT
INTERPRETATION/FORECASTING – ANALYSIS (DT)
CALIBRATED CONSISTENT (1D) RESERVOIR PROPERTIES
STATIC MODEL (3D)
DATA ENTRY
TEMPLATE MODELS
BUILD DYNAMIC MODEL (PVT,SCAL, SCHEDULE)
GRIDDING
INTERPRETATION
DIAGNOSTIC TOOLS
CALIBRATION VALIDATION
CREATE SOLUTIONS
FORECASTING COMPARATIVE ANALYSIS
DECISIONS
REPORTS

FIG.9

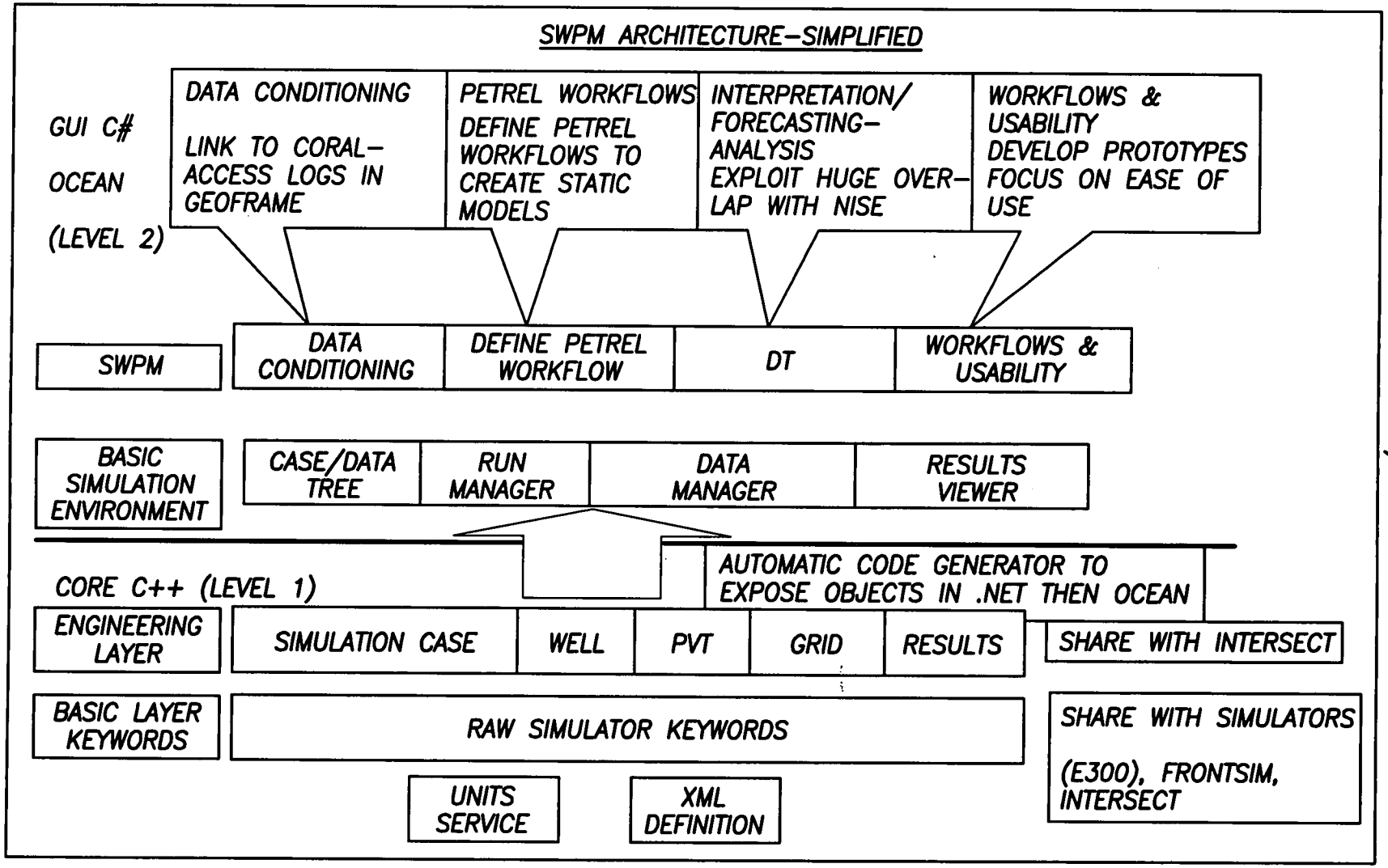
SWPM ARCHITECTURE–SIMPLIFIED
GUI C#
OCEAN
(LEVEL 2)
DATA CONDITIONING
LINK TO CORAL–ACCESS LOGS IN GEOFRAME
PETREL WORKFLOWS
DEFINE PETREL WORKFLOWS TO CREATE STATIC MODELS
INTERPRETATION/ FORECASTING–ANALYSIS
EXPLOIT HUGE OVER–LAP WITH NISE
WORKFLOWS & USABILITY
DEVELOP PROTOTYPES
FOCUS ON EASE OF USE
SWPM
DATA CONDITIONING
DEFINE PETREL WORKFLOW
DT
WORKFLOWS & USABILITY
BASIC SIMULATION ENVIRONMENT
CASE/DATA TREE
RUN MANAGER
DATA MANAGER
RESULTS VIEWER
CORE C++ (LEVEL 1)
AUTOMATIC CODE GENERATOR TO EXPOSE OBJECTS IN .NET THEN OCEAN
ENGINEERING LAYER
SIMULATION CASE
WELL
PVT
GRID
RESULTS
SHARE WITH INTERSECT
BASIC LAYER KEYWORDS
RAW SIMULATOR KEYWORDS
SHARE WITH SIMULATORS
(E300), FRONTSIM, INTERSECT
UNITS SERVICE
XML DEFINITION

FIG.9A

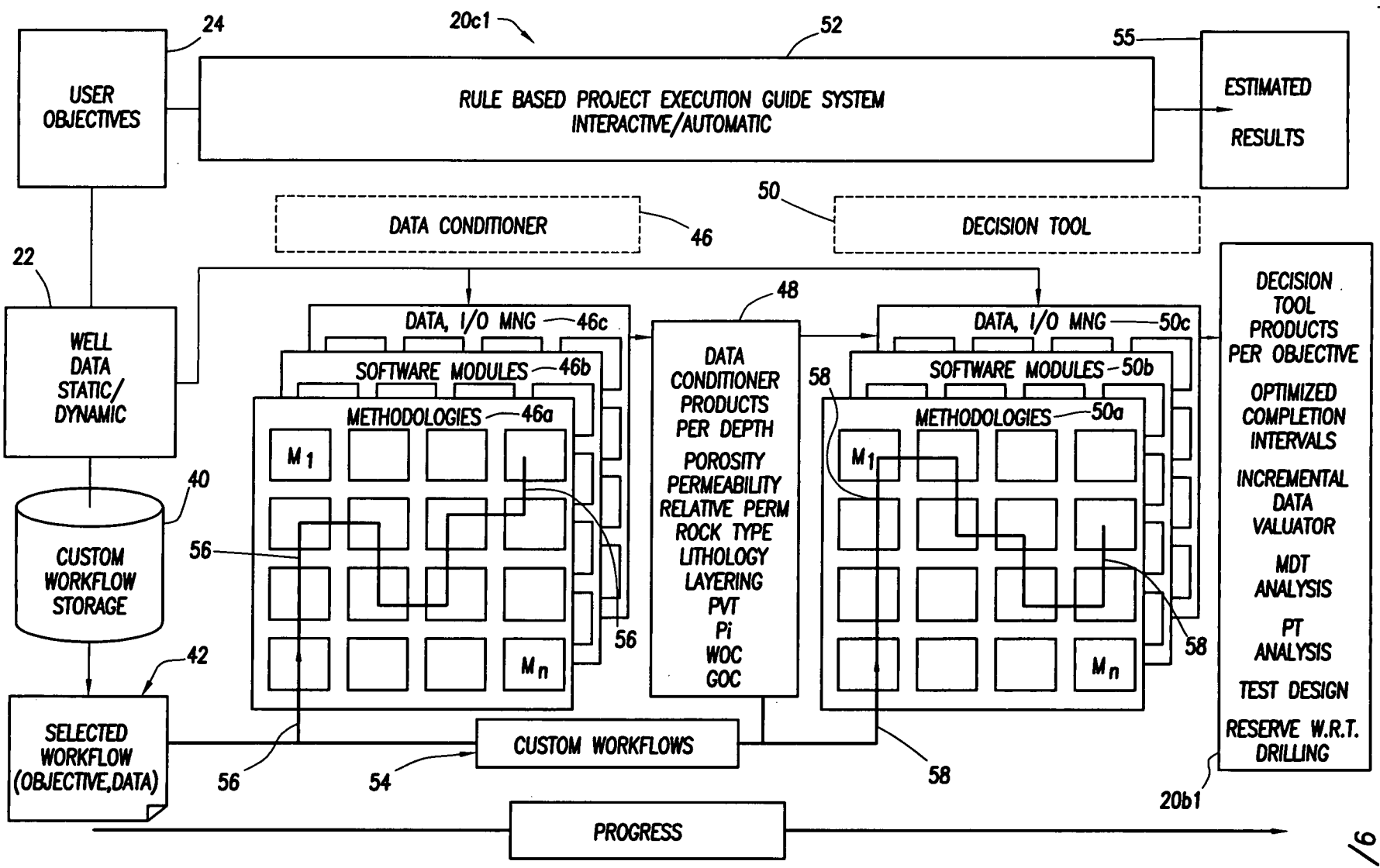
USER OBJECTIVES
24
20c1
RULE BASED PROJECT EXECUTION GUIDE SYSTEM
INTERACTIVE/AUTOMATIC
52
55
ESTIMATED
RESULTS
DATA CONDITIONER
46
50
DECISION TOOL
22
WELL
DATA
STATIC/
DYNAMIC
DATA, I/O MNG
46c
SOFTWARE MODULES
46b
METHODOLOGIES
46a
M 1
M n
48
DATA
CONDITIONER
PRODUCTS
PER DEPTH
POROSITY
PERMEABILITY
RELATIVE PERM
ROCK TYPE
LITHOLOGY
LAYERING
PVT
Pi
WOC
GOC
DATA, I/O MNG
50c
SOFTWARE MODULES
50b
METHODOLOGIES
50a
58
DECISION
TOOL
PRODUCTS
PER OBJECTIVE
OPTIMIZED
COMPLETION
INTERVALS
INCREMENTAL
DATA
VALUATOR
MDT
ANALYSIS
PT
ANALYSIS
TEST DESIGN
RESERVE W.R.T.
DRILLING
20b1
40
CUSTOM
WORKFLOW
STORAGE
56
42
SELECTED
WORKFLOW
(OBJECTIVE,DATA)
CUSTOM WORKFLOWS
54
PROGRESS

FIG. 10

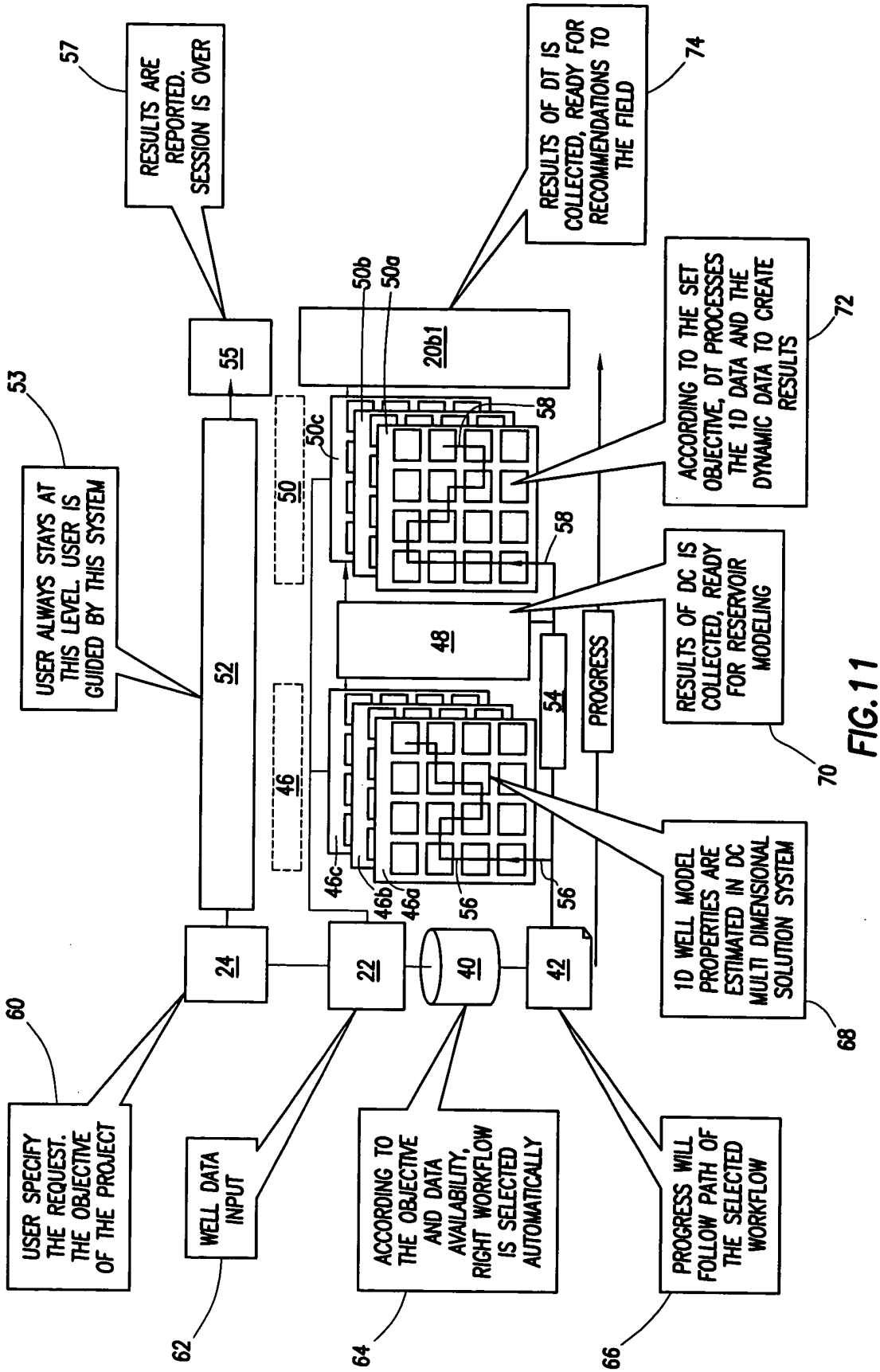
RESULTS ARE REPORTED. SESSION IS OVER
57
RESULTS OF DT IS COLLECTED, READY FOR RECOMMENDATIONS TO THE FIELD
74
55
20b1
50b
50a
58
50c
50
ACCORDING TO THE SET OBJECTIVE, DT PROCESSES THE 1D DATA AND THE DYNAMIC DATA TO CREATE RESULTS
72
53
USER ALWAYS STAYS AT THIS LEVEL. USER IS GUIDED BY THIS SYSTEM
52
48
RESULTS OF DC IS COLLECTED, READY FOR RESERVOIR MODELING
70
54
PROGRESS
46
46c
46b
46a
56
1D WELL MODEL PROPERTIES ARE ESTIMATED IN DC MULTI DIMENSIONAL SOLUTION SYSTEM
68
24
22
40
42
60
USER SPECIFY THE REQUEST. THE OBJECTIVE OF THE PROJECT
WELL DATA INPUT
62
ACCORDING TO THE OBJECTIVE AND DATA AVAILABILITY, RIGHT WORKFLOW IS SELECTED AUTOMATICALLY
64
PROGRESS WILL FOLLOW PATH OF THE SELECTED WORKFLOW
66

FIG. 11

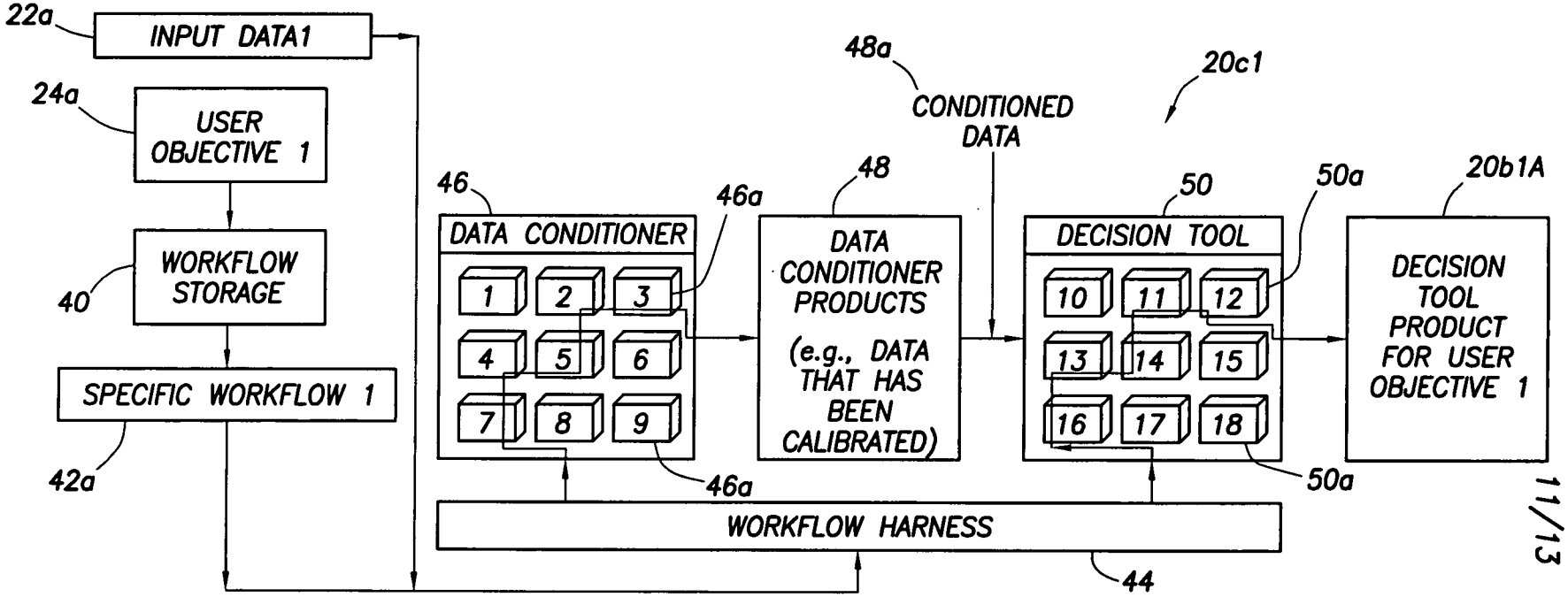
22a
INPUT DATA1
24a
USER OBJECTIVE 1
40
WORKFLOW STORAGE
SPECIFIC WORKFLOW 1
42a
46
DATA CONDITIONER
1
2
3
4
5
6
7
8
9
46a
46a
48
DATA CONDITIONER PRODUCTS
(e.g., DATA THAT HAS BEEN CALIBRATED)
48a
CONDITIONED DATA
20c1
50
DECISION TOOL
10
11
12
13
14
15
16
17
18
50a
50a
20b1A
DECISION TOOL PRODUCT FOR USER OBJECTIVE 1
WORKFLOW HARNESS
44
11/13

FIG. 12

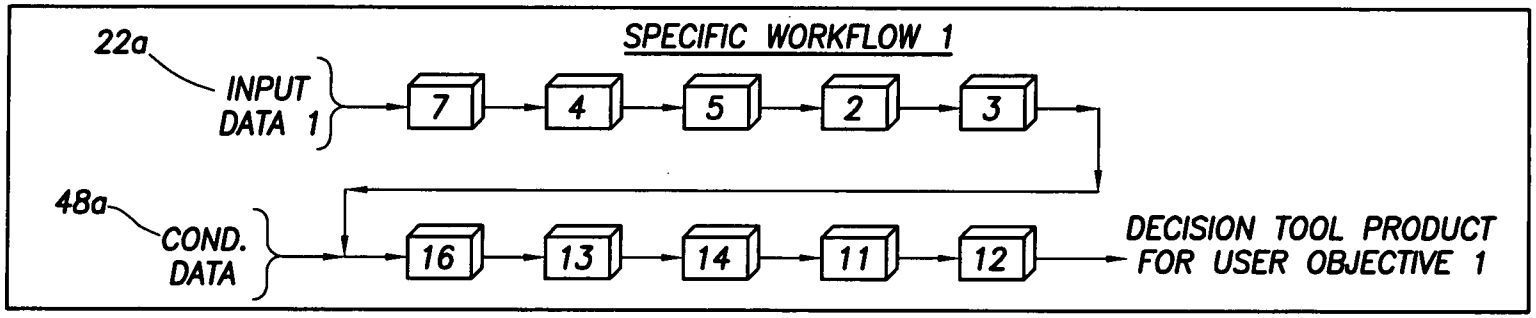
SPECIFIC WORKFLOW 1
22a
INPUT DATA 1
7
4
5
2
3
48a
COND. DATA
16
13
14
11
12
DECISION TOOL PRODUCT FOR USER OBJECTIVE 1

FIG. 13

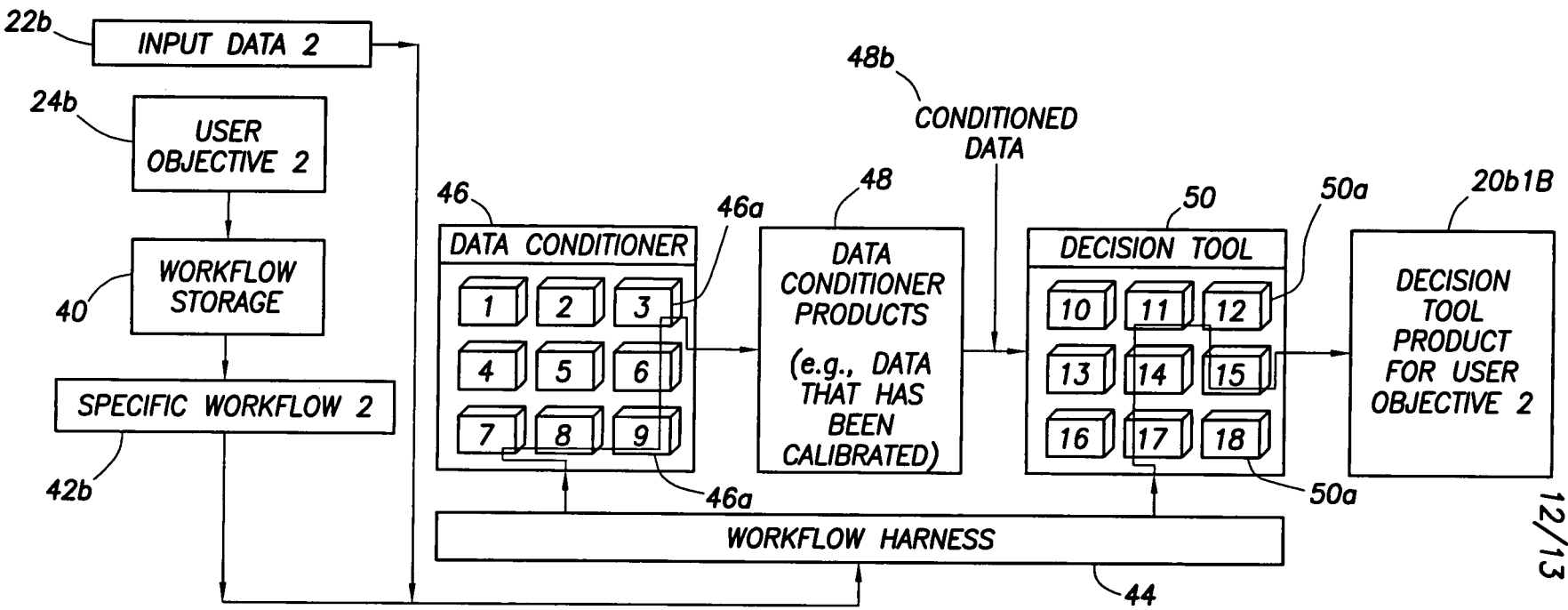
22b
INPUT DATA 2
24b
USER OBJECTIVE 2
40
WORKFLOW STORAGE
SPECIFIC WORKFLOW 2
42b
46
DATA CONDITIONER
1
2
3
4
5
6
7
8
9
46a
46a
48
DATA CONDITIONER PRODUCTS
(e.g., DATA THAT HAS BEEN CALIBRATED)
48b
CONDITIONED DATA
50
DECISION TOOL
10
11
12
13
14
15
16
17
18
50a
50a
20b1B
DECISION TOOL PRODUCT FOR USER OBJECTIVE 2
WORKFLOW HARNESS
44
12/13

FIG. 14

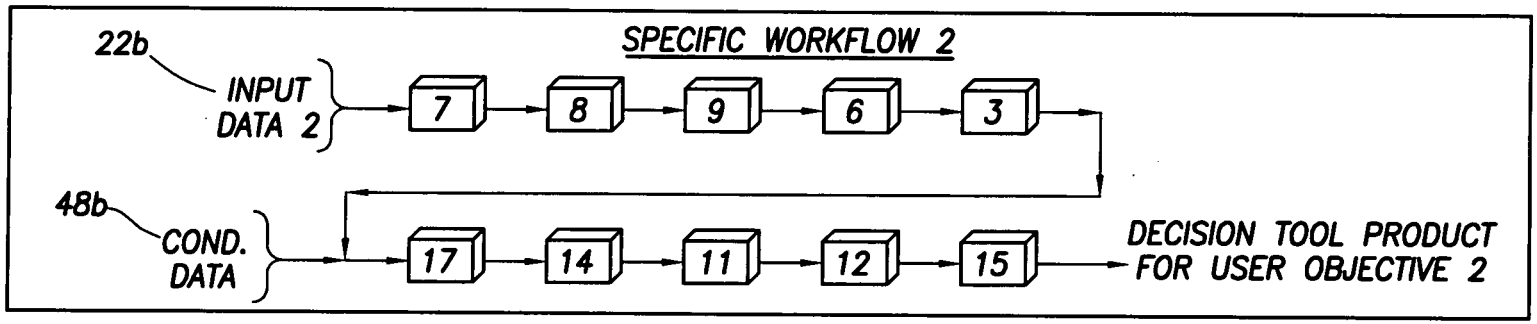
SPECIFIC WORKFLOW 2
22b
INPUT DATA 2
7
8
9
6
3
48b
COND. DATA
17
14
11
12
15
DECISION TOOL PRODUCT FOR USER OBJECTIVE 2

FIG. 15

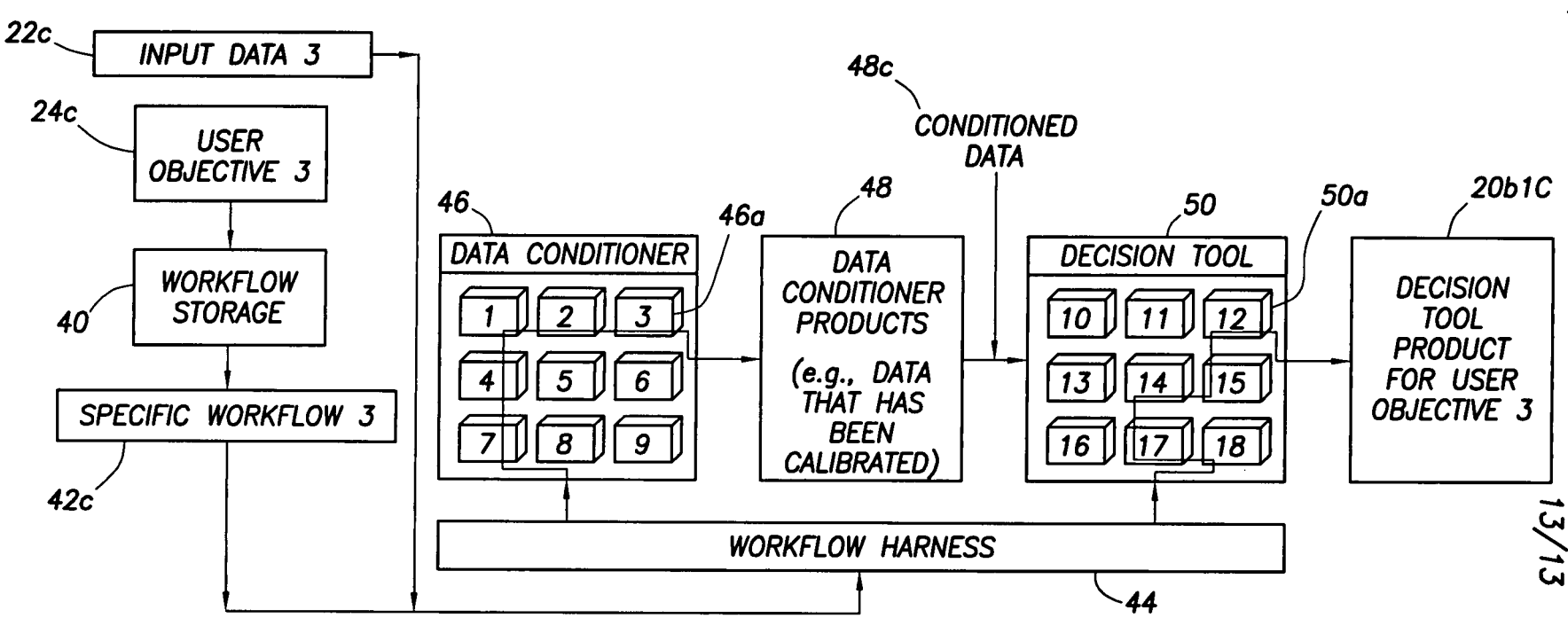
22c
INPUT DATA 3
24c
USER OBJECTIVE 3
40
WORKFLOW STORAGE
SPECIFIC WORKFLOW 3
42c
46
DATA CONDITIONER
1
2
3
4
5
6
7
8
9
46a
48
DATA CONDITIONER PRODUCTS
(e.g., DATA THAT HAS BEEN CALIBRATED)
48c
CONDITIONED DATA
50
DECISION TOOL
10
11
12
13
14
15
16
17
18
50a
20b1C
DECISION TOOL PRODUCT FOR USER OBJECTIVE 3
WORKFLOW HARNESS
44
13/13

FIG. 16

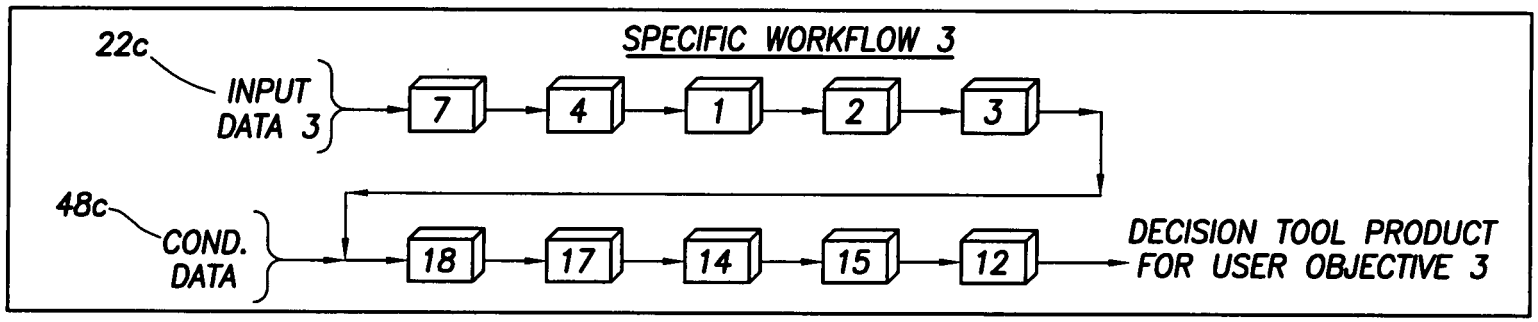
SPECIFIC WORKFLOW 3
22c
INPUT DATA 3
7
4
1
2
3
48c
COND. DATA
18
17
14
15
12
DECISION TOOL PRODUCT FOR USER OBJECTIVE 3

FIG. 17